Stewie Lab:

- Hypothesis should just be one variable.
- Reason for the cost analysis was to determine the lowest cost per ear of corn.
- We really cared about the lowest cost per ear of corn.

Density:

- Example

  1 kg of feathers

  1 kg of rocks

Volume → how much space something takes up

Mass → amount of matter in an object

Which has more volume?

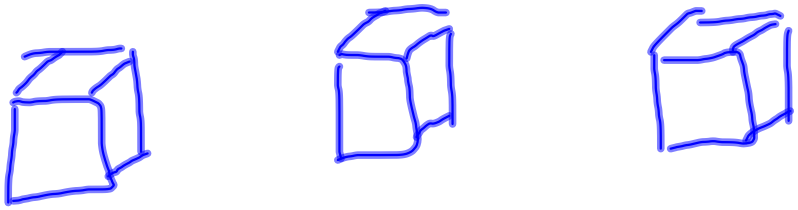
Feathers

Which has more mass?

Neither, they have the same mass.

- Definition of Density:
  - mass per unit volume
  - measure of how tightly packed atoms are in the material

- Another Example:



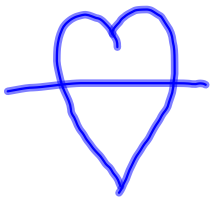
$V = 1\,cm^3$ $V = 1\,cm^3$ $V = 1\,cm^3$

wood water iron

$m = 0.5\,g$ $m = 1.0\,g$ $m = 8.0\,g$

IRON has the highest density

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{8\,g}{1\,cm^3} = 8\,\frac{g}{cm^3}$$



- Different objects have different densities.

SUBSTANCE	DENSITY (G/CM^3)
AIR	0.0013
WOOD (OAK)	0.85
WATER	1.00
ICE	0.93
ALUMINUM	2.7
LEAD	11.3
GOLD	19.3
ETHANOL	0.94
METHANOL	0.79

- Less dense substances float on more dense substances.

Least Dense: Vegetable Oil
0.75 g/cm³

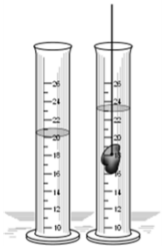
Most Dense: Honey
1.36 g/cm³

- Gases: 0.00 ___ g/cm³
- Liquids: ~0.5 to 1. ___ g/cm³
- Solids: ~0.2 to ~100 g/cm³

- Determining Density:
  - Measure mass
    - electronic scale
    - triple beam balance
  - measure volume
    - if "standard" object (standard meaning rectangular prism), use a ruler to measure.

      $V = (\text{length})(\text{width})(\text{height})$

    - use a graduated cylinder



      much easier for "non-standard" objects
    - place object in water and measure displacement of water

displacement = highest measurement − lowest measurement

- Calculate

uppercase $D = \frac{m}{V}$ lowercase / uppercase

- units: mass: grams
  volume: cm^3 or mL
  density: $\frac{g}{cm^3}$ or $\frac{g}{mL}$

Osmium is a very dense metal. What is its density in g/cm³ if 50.00 g of the metal occupies a volume of 2.22cm³?

$D = ?$

$m = 50\ g$

$V = 2.22\ cm^3$

$D = \frac{m}{V}$ ← MUST have your initial equation (in variables)

$= \frac{50\ g}{2.22\ cm^3}$

$= 22.5\ \frac{g}{cm^3}$

If blood has a density of 1.05 g/mL, how many milliliters of blood are donated if 575 g of blood are given?

$V(D) = \left(\frac{m}{V}\right)V$

$D = 1.05\ g/mL$

$V = ?$

$m = 575\ g$

$\frac{DV}{D} = \frac{m}{D}$

$V = \frac{m}{D}$

$= \frac{575\ g}{1.05\ g/mL}$

$= 547.6\ mL$

What is the density (g/cm^3) of 48 g of a metal if the metal raises the level of water in a graduated cylinder from 25 mL to 33 mL?

$D = ?$

$m = 48\ g$

$V = 33\ mL - 25\ mL = 8\ mL$

$$D = \frac{m}{V}$$

$$= \frac{48\ g}{8\ mL}$$

$$= 6\ g/mL$$